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Mussel community changes and environmental dynamics at Tour Eiffel, MAR

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Located on oceanic ridges, hydrothermal ecosystems are characterized by strong physico-chemical gradients and the presence of a unique fauna, sustained by microbial chemosynthesis. Several studies have shown that the spatial distribution and composition of vent faunal assemblages were strongly correlated to geological, physical and chemical processes at different spatial and temporal scales but almost no data are available on the temporal dynamics of these peculiar ecosystems.

During the last few years, we have developed and tested TEMPO: a long-term ecological module that couples up video imagery and environmental monitoring to identify the role of abiotic variations on the structure and dynamics of hydrothermal faunal assemblages. The first version of this module was deployed at 1650m depth in 2006 during the Momareto cruise, at the base of the Tour Eiffel edifice located in the Lucky Strike vent field on the Mid-Atlantic Ridge. TEMPO was recovered two years later and despite some difficulties, 45 days of imagery, 6 months of iron concentrations and 18 months of temperature were acquired in a Bathymodiolus azoricus mussel assemblage. A systematic protocol to manually analyze the video sequences was developed. The main biological features that could be extracted concern: (i) morphometric measurements and coverage, (ii) faunal behaviors and, (iii) interactions between species. Current and fluid flow intensity indices were added to the in situ measured factors. Results of this study will be presented and compared with those obtained from still photos of the same faunal assemblage during years 2006, 2008 and 2010.

A new up-dated version of TEMPO was designed in 2010 in the frame of the MoMAR deep-sea observatory (see presentation by Sarradin et al.). The module was deployed near a comparable B. azoricus assemblage located at the base of the same edifice. Since October 12 2010, this module is sending one photo of the assemblage per day coupled with environmental data (temperature, oxygen and iron concentrations) taken in the vicinity of the fauna. Preliminary observations from this new observatory experiment will also be presented.

In the longer term, imagery data along with abiotic factors will be investigated and compared using multivariate statistics including Principal Coordinate of Neighbor Matrices (PCNM) and cluster analyses. More specifically, we are looking to answer the following questions: (i) What biological, physical and geological data can be manually and automatically extracted from video imagery to feed the temporal data base?, (ii) what are the different scales of variations of environmental conditions (e.g. temperature, oxygen, iron)? and (iii) what are the links between environmental changes and faunal dynamics at different spatial scales in hydrothermal ecosystems? Ultimately, these data plus those from other scientific disciplines (physics, geophysics, chemistry), will be fed within a GIS that will allow for a graphical representation of all the observed temporal variations. The role of environmental factors on different aspects of vent faunal dynamics (community structure, behaviour, reproduction, colonization, activity rythms, etc) will be evaluated.

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